

NWQM Network for Coastal Waters— Overview and Lake Michigan Pilot

*Sue Brauer
U.S. EPA Region 5
Land and Chemicals Division*

NMN: When? Who? How?

1991	OMB Memo 92-01 Water Information Coordination Program From Two to One Committee
1992	Interagency Task Force on Monitoring Water Quality (1992-1997)
1996	FACA Advisory Committee on Water Information (ACWI) chartered
1997	National Water Quality Monitoring Council -ACWI subgroup
1997	ACWI first meeting
2000	Ocean Policy Act of 2000 & Commission 2000-2004
2004	U.S. Commission on Ocean Policy: Ocean Blueprint for the 21st Century Ch. 15 - NMN
2004	Bush Admin. Ocean Action Plan (E.O. 13366)
2005	CEQ, National Science and Technology Council Subcommittees on Oceans and Water Availability & Quality) ACWI ->NWQMC->NMN
2006	National Water Quality Monitoring Network for U.S. Coastal Waters and Their Tributaries by ACWI & NWQMC
2008	Pilot Reports

CEQ & NSTC to National Water Quality Monitoring Council

- Recommend a national monitoring network design that
 - Addresses and integrates watershed, coastal waters, and ocean monitoring, based on common criteria and standards.
 - Provides information on water quality that would provide relevant scientific information to assist resource management and decision making
 - Identify the major overarching management questions that need to be addressed and the fundamental elements of this national monitoring network (such as atmospheric deposition, surface water, ground water, and water quality, including biological monitoring), emphasizing the “federally funded backbone” of water quality networks and programs
- Tasks include case studies, identifying gaps in data and data networks for answering management questions, assessing resources, and compatibility with IOOS

NWQMN-Coastal & Tributaries

- 80 people
- Probabilistic basis for sampling
- Recommended regional pilots/IOOS Regions as a proof of concept
- Recommended interagency program staff (FTE)
- Federal Executive Branch Cabinet level briefed-- CEQ, NSTC, OMB, OSTP





NMN Design Considerations

- “Federal Monitoring Backbone” nationwide water resources information with additional state and federal monitoring
 - National Estuarine Research Reserve System (NERRS)
 - NOAA’s National Marine Sanctuaries (NMS) and Reserves
 - EPA’s National Estuary Program Sites
 - National Parks Along the Coast
 - Sleeping Bear Dunes and Indiana National Lakeshore
- Connectivity from uplands to coasts
- Constituent monitoring in at least three compartments to determine condition gradient
- Water quality issues: oxygen depletion, nutrient enrichment, toxic contamination, sedimentation, harmful algal blooms, habitat degradation, exotic species invasions, and pathogens

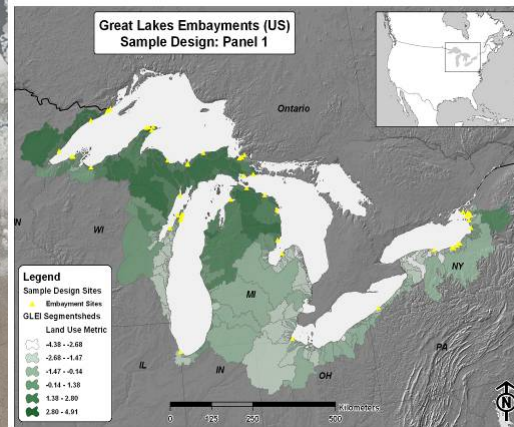


NMN/Great Lakes Compartments

- | | |
|--------------------------|--------------------------|
| • Estuaries | • Embayments |
| • Nearshore | • GL Shallow Nearshore |
| • Offshore | • GL Medium Nearshore |
| • Great Lakes | • GL Offshore |
| • Rivers | • Rivers |
| • Ground Water | • Ground Water |
| • Atmospheric Deposition | • Atmospheric Deposition |
| • Beaches | • Beaches |
| • Wetlands | • Wetlands |

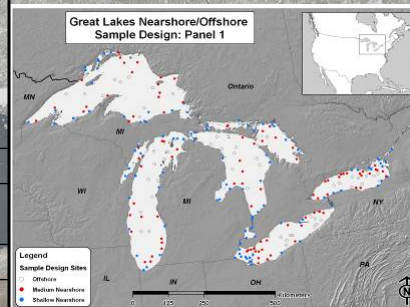
Great Lakes Embayments

- Lake Michigan
 - Calumet Harbor, IN
 - Baileys Harbor, WI
 - Little Bay de Noc, WI
 - Moonlight Bay, WI
 - Ephraim, WI
 - Little Sturgeon Bay, WI
 - Rowley Bay, WI
 - Little Traverse Bay, MI
 - North Bay
 - Big Bay de Noc, WI
 - Milwaukee Harbor, WI
 - Suttons Bay, MI
 - Indiana Harbor, IN
- Sampling design not specified



Great Lakes Near-/Off-shore

Lake	Shallow Medium Near-shore Boundary (m)	% of Area	Near shore/ Off-shore Boundary (m)	% of area within Near-shore	Mean Depth (m)
Superior	30	10.0	150	50.0	149
Michigan	30	25.9	80	51.4	85
Huron	20	25.1	50	51.9	59
Erie	10	19.5	20	54.8	19
Ontario	30	24.0	80	50.4	86



NMN Great Lakes Design

- Monitor condition of individual Great Lake and aggregate to GLOS reporting unit
 - 50 sample sites in each lake, depth stratified, 250 sites in GLOS per year, probability-based design assuring geographic coverage once per year on a five year rotation
- Monitor condition of individual lake
 - Variable number of sample sites per lake using existing shipboard surveys at fixed historical sites offshore; site selection by resource management agencies, sample frequency once or twice per year; ongoing (**No change to GLNPO limnology program**)
- Remote sensing and autonomous
 - Satellite, aircraft, in-water and shore-based sensors

NMN Design Rivers

- HUC 6 national scale
- Lake Michigan HUC 8





NMN Design Rivers

- Represent 90% of the water flow and loads of constituents from large watersheds at HUC-6: 1 to 3 sites per watershed (258 nationally), monthly plus high flows for 15 samples/year; 1/year for biological characterization & sediment quality
- Represent 97% of freshwater inflow to estuary and 70% of network estuary surface area, Variable # sites per estuary (72 nationally), monthly plus high flows for 15 samples/year; 1/year for biological characterization & sediment quality
- Represent outflow of basins to the Great Lakes draining 250 square miles, 1 site per watershed (56 nationally), monthly plus high flows for 15 samples/year; 1/year for biological characterization & sediment quality



NMN Design Groundwater

- To monitor direct inflow to coastal waters from coastal aquifers (not via rivers)
 - Reporting unit of one coastal aquifer, number of sites per unit will vary depending on significance of aquifer's flow and constituent load
 - Site selection by local & regional experts
 - Variable sample frequency

A satellite map of the Great Lakes region, showing the five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) and the surrounding land areas. The map is used as a background for the text.

NMN Design Atmospheric Deposition

- Monitor direct loads to estuaries and Great Lakes
 - Reporting unit of individual estuary and Great Lake
 - Number of sites per unit depends on size of reporting unit
 - Total number of sites deferred
 - Site selection by resource management agencies and technical experts
 - Continuous sampling

A satellite map of the Great Lakes region, showing the five Great Lakes (Superior, Michigan, Huron, Erie, and Ontario) and the surrounding land areas. The map is used as a background for the text.

NMN Design Beaches

- Monitor condition for recreational use
 - Report on basis of logical groupings to be determined
 - Number of sites per unit varies
 - Nationally, data records from 2,765 beaches
 - Sample all sites on record
 - Sample frequency approximately weekly
 - Annual sample interval

NMN Design Wetlands

- Monitor wetlands condition
- Reporting unit design deferred; tentatively by IOOS Region (Great Lakes) and wetland category
- Number of sites per unit, total number of sites, site selection (probably random), sample frequency (about once per year) and sample interval (5 year rotation) all deferred

Ocean.US

The National Office for
Integrated and Sustained Ocean Observations



The National Water Quality Monitoring Network for U.S. Coastal Waters and their Tributaries Pilot Phase Begins.

2 April 2007 – 10:25am

The U.S. EPA's Office of Water, working with the USGS and NOAA, has received twelve (12) expressions of interest in implementing the initial pilot phase of the new National Water Quality Monitoring Network for U.S. Coastal Waters and their Tributaries. The network will provide observations of pollution loads conveyed from inland watersheds to coastal waters through eight (8) linked "resource components" in the hydrologic system. The Pilot Studies will examine the effort needed to integrate the new network requirements into existing monitoring programs located in selected Regions of the U.S. The U.S. Committee on Ocean Policy (<http://ocean.ceb.gov/>) directed these three federal agencies to solicit expressions of interest after committees implementing the Ocean Action Plan accepted the national coastal monitoring network design. The new network was designed by 80 volunteers working through the National Water Quality Monitoring Council, including Staff from EPA's Office of Research and Development (ORD & EMAP).

Lake Michigan Pilot



News Release

April 13, 2006

Toni Johnson

703-648-6810

tjohnson@usgs.gov

National Water Quality Network Pilot Underway

A pilot phase of the National Water Quality Monitoring Network (Network) for U.S. Coastal Waters and their Tributaries is moving forward. The goal of the Network is to provide information about the health of our oceans and coastal ecosystems and inland influences on coastal waters for improved resource management.

The Network is unique because it uses an integrated, multidisciplinary approach and addresses a broad range of water resources, from upland watersheds to offshore waters. The design was developed by 80 representatives working through the National Water Quality Monitoring Council, including from Federal, state and local government organizations, universities, water associations and the private sector. The Council is a sub-committee of the Advisory Committee on Water Information, which is managed by the U.S. Geological Survey (USGS) for the Department of Interior. The Committee was charged to develop the design of the Network by the President's Council on Environmental Quality in response to a recommendation from the U.S. Commission on Ocean Policy.

The Network will coordinate water monitoring across the Nation to provide a comprehensive database and

Lake Michigan Pilot Report

Contaminants Example

- Database began with NAWQA analyte list
 - WI Long Term Trends Ambient Water Quality Network
 - IL Lake Michigan Basin
 - IN Rotating Basin, Statewide Fixed Station
 - MI Water Chemistry Monitoring Program
 - GLNPO Limnology Program in Offshore
 - GLNPO Fish Monitoring Program
 - Integrated Air Deposition Network
 - NOAA Mussel Watch

Lake Michigan Pilot Report Contaminants

(cont.)

- All states monitor temperature, pH, chloride, cadmium, chromium, copper, nickel, sodium, zinc, PCBs in fish and/or water, and mercury in tissue and/or water
- Of these 11 common parameters, GLNPO reports total PCBs in its fish monitoring program, representing the off shore while Mussel Watch and IADN report on a congener-specific basis representing the shallow near shore. IADN reports on both a congener-specific basis and a total PCB basis.

Number of federal programs monitoring x parameter	Number of States Monitoring x Parameter					
	zero	one	two	three	four	
zero		67	18	8	0	
one	64	43	11	8	6	
two	14	19	8	2	5	
three	2	3	3	4	0	
four	0	0	0	0	0	

NMN Management Questions Lake Michigan Pilot Thoughts

- What is the Condition of the Nation's surface, ground, estuarine, and coastal waters?
- Look at the CWA 303(d)/305(b) consolidated reports State-by-State because pulling the data is too hard. NWIS is easy, GLENDa is easy, STORET data entered by all states?
- From shallow near shore to offshore, condition is unknown

NMN Management Questions Lake Michigan Pilot Thoughts

- Where, how, and why are water quality conditions changing over time?
- States do river water quality
- Lake Michigan monitored >80 m
- Beach monitoring via Beach Act grants
- AOCs monitored via state 5 year rotation
- < 80 m depth at drinking water intakes and at southern end
- GLFMP tells a good story

NMN Management Questions Lake Michigan Pilot Thoughts-- Depends on Location

- Where/What are problems related to water quality?
- Beaches-pathogens
- Fish-contaminants
- Nutrient enrichment
- Nuisance algal blooms
- Habitat degradation
- Aquatic invasive species

An aerial photograph of Lake Michigan and its surrounding land areas. The lake is dark blue, and the surrounding land is a mix of brown and green, indicating different types of terrain and vegetation. The text is overlaid on the image in a white, sans-serif font.

NMN Management Questions Lake Michigan Pilot Thoughts

- What is causing the problems?
 - Beaches-pathogens
 - Fish-contaminants
 - Nutrient enrichment
 - Nuisance algal blooms
 - Habitat degradation
 - Aquatic invasive species
- Measurement tool, source identification
- Legacy pollutants, limited testing
- Nonpoint sources of nutrients
- Inc. load or changed P cycle in lake?
- Invasive species
- Human society

An aerial photograph of Lake Michigan and its surrounding land areas. The lake is dark blue, and the surrounding land is a mix of brown and green, indicating different types of terrain and vegetation. The text is overlaid on the image in a white, sans-serif font.

NMN Management Questions Lake Michigan Pilot Thoughts

- Are programs to prevent or remediate problems working effectively?
- Limited (negotiated in lieu of mandatory) monitoring data at remediation sites limits ability to answer.
- Grand Calumet shows improvement
- TSCA ban on PCBs and FIFRA cancellations evident
- Is technical infeasibility a problem for NPDES permits limiting PCBs and mercury?

NMN Management Questions Lake Michigan Pilot Thoughts

- What research activities are needed to support these important resources and ensure they are understood and sustainable?
- More nutrient monitoring of the shallow and medium nearshore for comparable metrics and source identification
- Semi-permeable membrane device monitoring of regulated bioaccumulative toxic substances for a load metric not affected by changes in the food web
- Method development, computational toxicology, and rapid screening for pollutants

Lake Michigan Pilot Report

- \$25 million gap
 - Shallow nearshore \$83,520 based on 21 IEPA sites
 - Medium nearshore unknown
 - Offshore based on GLNPO <~ \$1 million/lake, unknown additional estimate for probabilistic
 - Rivers \$500,000 being spent on 20 proposed sites, need \$1.2 million to fill gaps
 - Groundwater \$12,000 for 5 existing wells, need 32 new wells additional costs \$135,500
 - Wetlands \$800,000 current estimate, unknown additional
 - Beaches currently \$780,000, need \$2,528,400
 - Atmospheric Deposition unknown

Pilot Report Gap Analyses

w=water, s=sediments, c=contaminants, b=biology, p=physical char.

- Pilots didn't agree how to count:
 - By number of measurements relative to design
 - By proportion of requested contaminants
 - By number of states out of four
 - By number of reporting units, number of sites per reporting unit, total number of sites, sample frequency or interval . . .

NMN Refinement Summary Report

- Available February 2008
<http://acwi.gov/monitoring/network/>
- Nutrients: lists required parameters and performance requirements
- Contaminants: 243 compounds
 - 28 metals/metaloids, 47 VOCs, 40 pesticides, 57 halogenated hydrocarbons, 71 PAHs
- Wetlands: 3 tiers
 - Landscape Level detected remotely, Rapid Assessment in the field by trained personnel, & Intensive Observations laboratory



NMN Refinement Summary Report

- Biology: number, frequency, interval undetermined
 - Macroalgae density; Habitat mapping; Seagrass cover; DELTs; Sediment Quality Triad; Dissolved oxygen level; HABs; Status of an “ecologically significant” species in an estuary; Epiphytes; Chlorophyll a; Macrobenthic Fauna; Bird Community Census; Status of Marine animal considered sentinel of environmental change; Commercial fish & shell fish landings; Presence of non-indigenous species; WQI; Coastal Habitat Index; Sediment Quality Index
- Atmospheric Deposition: benchmark stations and supporting stations every 7-24 days to coordinate with other sampling, one site per estuary, over water
 - Wet deposition nitrate, ammonium, and organic nitrogen, methyl and total mercury
 - Dry deposition gaseous ammonia, oxidized nitrogen species, particulate nitrate and ammonium, mercury (meas. or est.)
 - Deposition of PAHs, PCBs, SVOCs

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Monitoring and Standards